

o start MacRTrace, just double-click on its icon in the Finder. MacRTrace will start up and show you its nifty About... box. If you have QuickTime installed, and you click the right thing, something truly nifty will happen. Once you've seen enough of it, click on the Okay! button. (If you don't find the about box so nifty after the tenth time or so, you can turn it off; see the Preferences section).

You should see the Log Window now. The Log Window gives you technical feedback about the scene MacRTrace is processing. Since MacRTrace isn't processing anything yet, the Log Window is empty.

Now choose Open... from the File menu. This will bring up a standard Open... window. Use it to open demo.sff, a scene description file included with MacRTrace.

MacRTrace will open the Status Window (which provides basic information about what's going on, and how much memory you have left) and will read the scene into memory. Then it will present you with the Options Window:

he complexity of the window can be intimidating, but relax. The default options will do nicely for most purposes. As you become more familiar with MacRTrace, you can experiment with some of the more complex options.

For now, we'll just change the size of the image. The Image Width and Image Height fields contain the width and height, in pixels, of the image which MacRTrace will generate. For now, change them both to 100. This will create a 100x100 image, which is small enough that it won't take long even on slower machines.

Now that we've set the options as we would like, we're ready to go. Click on the Render button. MacRTrace will bring up the Image Window, and the Log Window will fill up while MacRTrace gets ready to ray trace. Then MacRTrace will begin generating the image, a pixel at a time. This could take a while. If not, you will be able to tell how far along it is by looking at the thermometer in the Status Window.

When it's all done, the image window will look like this:

f your monitor can only display 256 colors, you may notice some banding on the objects, particularly the sphere and the plane. This is normal. However, you can get a better-looking picture by forcing the Image Window to update, perhaps by covering and uncovering it with another window. The image will be drawn dithered, resulting in much better-looking shades of color. Note that the image is stored internally using full 24-bit color, so the internal image, and any images you save, will not have these color-related flaws. You can save the image by choosing Save... from the File menu. It will be saved as a 24-bit color PICT file, acceptable by most Mac applications.

Now let's do a simple animation. The Options Window should still be visible—click on the Animate... checkbox (top and center). This makes the Animation Window visible. Click to bring it to the front, and it will look like this:

gain, this can look a little intimidating. Again, the defaults are fine. In a nutshell, the Eye Point is point in space we're looking from. The Look Point is the point we're looking at. The Up vector is a vector which points in the direction which we want to appear to be up. And the Angle aperture is the number of degrees in our view. MacRTrace has already entered the default values of these parameters for this scene into the appropriate fields.

Doing animation with MacRTrace, unlike most other features of MacRTrace, requires a real understanding of some mathematical concepts. You need to know how to define an equation parametrically, and you need to have a good concept of what a vector is. It also requires an understanding of space and the standard three-dimensional coordinate system ( $x$ ,  $y$ , and  $z$ ). If you don't understand these things, you probably will have a hard time making effective animation. These topic are covered in many geometry and calculus textbooks.

For this example, what we want to do is make a simple circular orbit around the scene. You can always assume that the default values are a decent viewpoint, so we'll work from there.

Parametrically, a circular path in two dimensions is described by  $(x, y) = (r \sin t, r \cos t)$ . Noticing that "up" in `demo.sff` is in the  $y$  direction (as indicated by the Up vector  $(0, 1, 0)$ ), we will plot a course which takes us in a circle around the center of the scene, remaining at a constant height above the "ground." A suitable course is  $(x, y, z) = (-25 \sin t, 25, 25 \cos t)$ . We choose 25 for  $y$  here because the

positive y direction is “up,” and we want to be at a constant “height” (above the xz plane). Since the Look Point is (0, 0, 0), we know that the center of the orbit will be directly above the center of the scene.

Now enter the equations. MacRTrace, like most computer programs, isn’t smart enough to deal with implied multiplication or implied parentheses. So every time you want multiplication, you need to include an asterisk (\*) between the multiplier and the multiplicand. Also, when use a function like sin, be sure to include parentheses around its argument. The correct format for the parametric equations are  $x(t) = -25*\sin(t)$ ,  $y(t) = 25$ ,  $z(y) = 25*\cos(t)$ . Enter these equations now in the Eye Point fields.

The variable t represents time. It is chosen by default to run from 0 to  $2*\pi$ , which is perfect for a circular orbit. So we will leave the settings for t alone, and leave the number of frames at 10.

Click the Okay button to return to the Options Window, and then click Render & Save. The button has changed its name because an animation cannot be rendered directly to memory, as an image can, so we will need to save the animation as we render it. MacRTrace immediately prompts us for the file(s) to save to. If you have QuickTime, save the animation as a QuickTime movie by choosing from the popup menu. If you don’t leave things as they are. Choose a filename and click Okay. If you’re saving as a QuickTime movie, another window will come up, asking you to specify the compression options. The defaults are fine, or you can choose other settings if you prefer.

MacRTrace will now render ten different views of demo.sff, evenly spaced around the circular path we requested. Actually, they won’t all be different, because MacRTrace will render at both  $t=0$  and  $t=2\pi$ , which will be identical since sine and cosine are periodic functions with period  $2\pi$ .

Since MacRTrace has to render ten frames, this rendering will take ten times longer than the previous one. Be very sure you know what you’re doing when you start an animation rendering—it can take a long time! If you ever want to abort a rendering, just press  $\hat{\mathcal{E}}$ -period.

When the movie is done, try playing it from a QuickTime movie player. It will be best played in Repeat mode.

Now go back and try playing with some of the options. Try setting the Supersampling to “better” or “best” for better quality images. Try using larger or

smaller image dimensions. Try some more animations, with different paths, or with the up vector or the look point changing with  $t$ . Experiment! MacRTrace is FUN!